TIGHT CHALK: HOW DO SEDIMENTOLOGY AND DIAGENESIS INFLUENCE MICROTEXTURE? HOW DOES MICROTEXTURE CONTROL RESERVOIR PROPERTIES?

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Since the discovery of the Ekofisk chalk hydrocarbon reservoir in the North Sea in the 1960s, porous reservoir chalk has been extensively studied. Only recently, there has been an increasing interest in understanding low reservoir-quality or tight chalks. Defined by a permeability lower then 0.2 mD, they may act as seals or form potential unconventional reservoirs. In order to better understand their characteristics, an integrated petrographical, petrophysical and geomechanical study was carried out on a set of 65 samples from NW-Europe outcrops. The dataset gathered covers a broad spectrum of values regarding petrophysical (e.g. porosities from 9 to 45%) and geomechanical properties (e.g: strengths from 3 to 50 MPa). The key parameter defining chalk intrinsic properties is its microtexture. Tight chalks encompass different lithotypes, but the main factors controlling microtexture are the non-carbonate content and degree of cementation. The respective influence of the depositional setting (e.g. detrital input) and diagenesis (eogenesis and mesogenesis) on the microtexture are unravelled. FIB-SEM analyses on 3 distinct samples (micritic, argillaceous and cemented chalk) show how these parameters modify porous network. The link between the observed porous network and the petrophysical and geomechanical properties of the samples was investigated. High degree of cementation and non carbonate content result in lower poroperm values. Cementation was proven to increase chalk strength and brittleness. Moreover, high clay content significantly reduces permeability and increases the rock plasticity.